

WE CLAIM:

1. A process for producing a carboxylic acid/diol mixture, said process comprising:
 - (a) removing in a liquor exchange zone impurities from a carboxylic acid slurry to form a water-wet carboxylic acid cake, a mother liquor stream, a solvent mother liquor stream, and a solvent/water byproduct liquor stream;
 - (b) routing said water-wet carboxylic acid cake to a vapor seal zone; and
 - (c) adding at least one diol to said water-wet carboxylic acid cake in a carboxylic acid/diol mixing zone to form said carboxylic acid/diol mixture.
2. A process according to claim 1 wherein said carboxylic acid is selected from a group consisting of terephthalic acid, isophthalic acid, naphthalene dicarboxylic acid, trimellitic acid, and mixtures thereof.
3. A process according to claim 1 or 2 wherein said diol is selected from the group consisting of ethylene glycol, diethylene glycol, n-butylene glycol, i-butylene glycol, n-propylene glycol, 1,4 butanediol, cyclohexanedimethanol, and mixtures thereof.
4. A process according to claim 1 wherein said carboxylic acid/diol mixing zone comprises at least one device selected from the group consisting of an agitated vessel, a static mixer, a screw conveyor, and a PET esterification reactor.

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5. A process according to claim 1 wherein said carboxylic acid is terephthalic acid and said diol is ethylene glycol.

6. A process for producing a carboxylic acid/diol mixture, said process comprising:

5 (a) removing in a solvent liquor exchange zone impurities from a carboxylic acid slurry to form a carboxylic acid cake with solvent, a mother liquor stream, and a solvent mother liquor stream;

(b) adding water in a water wash zone to said carboxylic cake with solvent to produce a water-wet carboxylic acid cake and a

10 solvent/water by product liquor stream;

(c) routing said water-wet carboxylic acid cake to a vapor seal zone; and

(d) adding at least one diol to said water-wet carboxylic acid cake in a carboxylic acid/diol mixing zone to form said carboxylic acid/diol

15 mixture.

7. A process according to claim 6 wherein said carboxylic acid is selected from a group consisting of terephthalic acid, isophthalic acid, naphthalene dicarboxylic acid, trimellitic acid and mixtures thereof.

8. A process according to claim 6 or 7 wherein said diol is selected 20 from the group consisting of ethylene glycol, diethylene glycol, n-butylene glycol, i-butylene glycol, n-propylene glycol, 1,4 butanediol, cyclohexanedimethanol, and mixtures thereof.

9. A process according to claim 6 wherein said carboxylic acid/diol mixing zone comprises at least one device selected from the group consisting of an agitated vessel, a static mixer, a screw conveyor, and a PET esterification reactor.
- 5 10. A process according to claim 6 wherein said carboxylic acid is terephthalic acid and said diol is ethylene glycol.
11. A process for producing a carboxylic acid/diol mixture, said process comprising:
 - (a) removing in a solid-liquid separation zone impurities from a carboxylic acid slurry to form a slurry or cake carboxylic acid product and a mother liquor stream;
 - 10 (b) removing in a solvent-water liquor exchange zone residual impurities from said slurry or cake carboxylic acid product to form a water-wet carboxylic acid cake, a solvent mother liquor stream, and a solvent/water byproduct liquor stream;
 - 15 (c) routing said water-wet carboxylic acid cake to a vapor seal zone; and
 - (d) adding at least one diol to said water-wet carboxylic acid cake in a carboxylic acid/diol mixing zone to form said carboxylic acid/diol mixture.
- 20 12. A process according to claim 11 wherein said carboxylic acid is selected from a group consisting of terephthalic acid, isophthalic acid, naphthalene dicarboxylic acid, trimellitic acid and mixtures thereof.

13. A process according to claim 11 or 12 wherein said diol is selected from the group consisting of ethylene glycol, diethylene glycol, n-butylene glycol, i-butylene glycol, n-propylene glycol, 1,4 butanediol, cyclohexanedimethanol, and mixtures thereof.
- 5 14. A process according to claim 11 wherein said carboxylic acid/diol mixing zone comprises at least one device selected from the group consisting of an agitated vessel, a static mixer, a screw conveyor, and a PET esterification reactor.
- 10 15. A process according to claim 11 wherein said carboxylic acid is terephthalic acid and said diol is ethylene glycol.
16. A process for producing a carboxylic acid/diol mixture, said process comprising the following steps:
 - (a) removing a solvent from a slurry or cake carboxylic acid product in a solvent-water liquor exchange zone; wherein a substantial portion of the solvent in said slurry or cake carboxylic acid product is replaced with water to form a water-wet carboxylic acid cake;
 - (b) routing said water-wet carboxylic acid cake to a vapor seal zone; and
 - (c) adding at least one diol to said water-wet carboxylic acid cake in a carboxylic acid/diol mixing zone to form said carboxylic acid/diol mixture.

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17. A process according to claim 16 wherein said carboxylic acid is selected from a group consisting of terephthalic acid, isophthalic acid, naphthalene dicarboxylic acid, trimellitic and mixtures thereof.
18. A process according to claim 16 or 17 wherein said diol is selected from the group consisting of ethylene glycol, diethylene glycol, n-butylene glycol, i-butylene glycol, n-propylene glycol, 1,4 butanediol, cyclohexanedimethanol, and mixtures thereof.
19. A process according to claim 16 wherein said carboxylic acid/diol mixing zone comprises at least one device selected from the group consisting of an agitated vessel, a static mixer, a screw conveyor, and a PET esterification reactor.
20. A process for producing a terephthalic acid/diol mixture, said process comprising:
 - (a) removing in a solvent wash zone residual impurities from a slurry or cake terephthalic acid product to form a terephthalic acid cake with acetic acid;
 - (b) removing a substantial portion of a solvent in a water wash zone from said terephthalic acid cake with acetic acid to form a water-wet terephthalic acid cake; and
 - (c) routing said water-wet terephthalic acid cake to a vapor seal zone; and

(d) adding at least one diol to said water-wet terephthalic acid cake in a carboxylic acid/diol mixing zone to form said terephthalic acid/diol mixture.

21. A process according to claim 20 wherein said solvent wash zone 5 comprises a solid-liquid separation device that is operated at a temperature between about 40 °C to about 155 °C.
22. A process according to claim 21 wherein said water wash zone comprises a solid-liquid separation device that is operated at a temperature between about 40 °C to about 155 °C.
- 10 23. A process according to claim 20 or 21 wherein said adding occurs at a temperature between about 40 °C to about 290 °C.
24. A process according to claim 20 wherein said diol is selected from the group consisting of ethylene glycol, diethylene glycol, n-butylene glycol, i-butylene glycol, n-propylene glycol, 1,4 butanediol, 15 cyclohexanedimethanol, and mixtures thereof.
25. A process according to claim 20 wherein said diol is ethylene glycol.
26. A process according to claim 20 wherein said carboxylic acid/diol mixing zone comprises a device selected from the group consisting of an agitated vessel, a static mixer, a screw conveyor, and a PET esterification 20 reactor.
27. A process for producing a terephthalic acid/diol mixture, said process comprising:

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- (a) removing a solvent from a slurry or cake terephthalic acid product in a solvent-water liquor exchange zone; wherein a substantial portion of the solvent in said slurry or cake terephthalic acid product is replaced with water to form a water-wet terephthalic acid cake;
- 5 (b) routing said water-wet terephthalic acid cake to a vapor seal zone; and
- (c) adding at least one diol to said water-wet terephthalic acid cake in a carboxylic acid/diol mixing zone to form said terephthalic acid/diol mixture.

10 28. A process according to claim 27 wherein said solvent liquor exchange zone comprises a solid-liquid separation device that is operated at a temperature between about 40 °C to about 155 °C.

29. A process according to claim 27 wherein said adding occurs at a temperature between about 40 °C and 290 °C.

15 30. A process according to claim 27 wherein said diol is selected from the group consisting of ethylene glycol, diethylene glycol, n-butylene glycol, i-butylene glycol, n-propylene glycol, 1,4 butanediol, cyclohexanedimethanol, and mixtures thereof.

31. A process according to claim 27 wherein said diol is ethylene glycol.

20 32. A process according to claim 27 wherein said carboxylic acid/diol mixing zone comprises a device selected from the group consisting of an agitated vessel, a static mixer, a screw conveyor, and a PET esterification reactor.

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33. A process for producing a terephthalic acid/diol mixture, said process comprising:

- (a) removing in a solvent wash zone residual impurities from a slurry or cake terephthalic acid product from a terephthalic acid cake with 5 acetic acid; wherein said solvent wash zone comprises at least one solid-liquid separation device that is operated at a temperature between about 40 °C to about 155 °C ;
- (b) removing a substantial portion of a solvent in a water wash zone from said terephthalic acid cake with acetic acid to form a water-wet 10 terephthalic acid cake; wherein said water wash zone comprises at least one solid-liquid separation device that is operated at a temperature between about 40 °C to about 155 °C;
- (c) routing said water-wet terephthalic acid cake to a vapor seal zone; and
- 15 (d) adding at least one diol to said water-wet terephthalic acid cake in a carboxylic acid/diol mixing zone to form said terephthalic acid/diol mixture; wherein said adding occurs at a temperature between about 40 °C to about 290 °C; wherein said diol is ethylene glycol.

34. A process for producing a carboxylic acid/diol mixture, said process 20 comprising:

- (a) removing in a solid-liquid separation zone impurities from a carboxylic acid slurry to form a slurry or cake carboxylic acid product and a mother liquor stream;

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- (b) adding solvent to a slurry or cake carboxylic acid product in a solvent wash zone to said slurry or cake carboxylic acid product to produce a carboxylic acid cake with solvent and a solvent mother liquor stream;
- (c) optionally, adding water in a water wash zone to said
- 5 carboxylic cake with solvent to produce a water-wet carboxylic acid cake and a solvent/water by product liquor stream;
- (d) routing said water-wet carboxylic acid cake or said carboxylic acid cake with solvent to a vapor seal zone; and
- (e) adding at least one diol to said water-wet carboxylic acid cake
- 10 in a carboxylic acid/diol mixing zone to form said carboxylic acid/diol mixture.

35. A process according to claim 34 wherein said carboxylic acid is selected from a group consisting of terephthalic acid, isophthalic acid, naphthalene dicarboxylic acid, trimellitic acid and mixtures thereof.

15 36. A process according to claim 34 or 35 wherein said diol is selected from the group consisting of ethylene glycol, diethylene glycol, n-butylene glycol, i-butylene glycol, n-propylene glycol, 1,4 butanediol, cyclohexanedimethanol, and mixtures thereof.

37. A process according to claim 34 wherein said carboxylic acid/diol

20 mixing zone comprises at least one device selected from the group consisting of an agitated vessel, a static mixer, a screw conveyor, and a PET esterification reactor.

38. A process according to claim 34 wherein said carboxylic acid is terephthalic acid and said diol is ethylene glycol.
39. A process for producing a terephthalic acid/diol mixture, said process comprising:
 - 5 (a) removing in a solid-liquid separation zone impurities from a terephthalic acid slurry to form a slurry or cake terephthalic acid product and a mother liquor stream;
 - (b) adding solvent in a solvent wash zone to said slurry or cake terephthalic acid product to produce a terephthalic acid cake with solvent and a solvent mother liquor stream;
 - 10 (c) optionally, adding water in a water wash zone to said terephthalic acid cake with solvent to produce a water-wet terephthalic acid cake and a solvent/water by product liquor stream;
 - (d) routing said water-wet terephthalic acid cake or said 15 carboxylic acid cake with solvent to a vapor seal zone; and
 - (e) adding at least one diol to said water-wet terephthalic acid cake in a carboxylic acid/diol mixing zone to form said terephthalic acid/diol mixture.
40. A process according to claim 39 wherein said solvent wash zone 20 comprises a solid-liquid separation device that is operated at a temperature between about 40 °C to about 155 °C.

41. A process according to claim 40 wherein said water wash zone comprises a solid-liquid separation device that is operated at a temperature between about 40 °C to about 155 °C.
42. A process according to claim 39 or 40 wherein said adding occurs at 5 a temperature between about 40 °C and about 290 °C.
43. A process according to claim 39 wherein said diol is selected from the group consisting of ethylene glycol, diethylene glycol, n-butylene glycol, i-butylene glycol, n-propylene glycol, 1,4 butanediol, cyclohexanedimethanol, and mixtures thereof.
- 10 44. A process according to claim 39 wherein said diol is ethylene glycol.
45. A process according to claim 39 wherein said carboxylic acid/diol mixing zone comprises a device selected from the group consisting of an agitated vessel, a static mixer, a screw conveyor, and a PET esterification reactor.
- 15 46. A process according to claim 34 or 39 wherein said solvent is added counter current to the flow of said slurry or cake carboxylic acid product.
47. A process according to claim 34 or 39 wherein said water is added counter current to the flow of said carboxylic acid cake with solvent.
48. A process according to claim 46 wherein said water is added counter 20 current to the flow of said carboxylic acid cake with solvent.
49. A process according to claim 48 wherein said water wash zone comprises from about 2 to about 4 stages of water counter current washes.

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50. A process according to claim 46 wherein said solvent wash zone comprises from about 2 to about 4 stages of solvent counter current washes.
51. A process according to claim 47 wherein said water wash zone comprises from about 2 to about 4 stages of water counter current washes.